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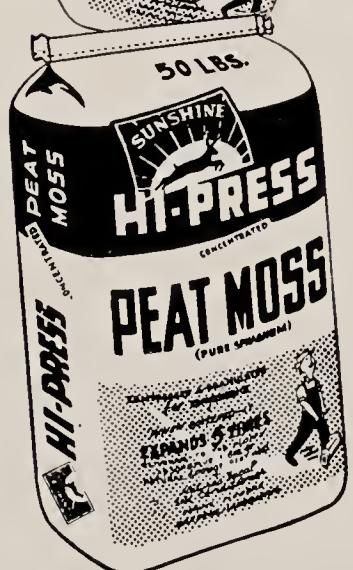
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The Arboretum Bulletin

VOLUME XVIII

WINTER, 1955

NUMBER 4

Some New Zealand Alpines

ROBERT ORNDUFF*

LAST year I spent several months in New Zealand studying botany under a Fulbright grant. During that time I made several collecting trips throughout the country and became convinced that the rich and varied flora contains many species which have potential value as horticultural material in this country. It is true that there are many New Zealand species cultivated in the United States as well as in Great Britain, but those species most popular in this country are those more suited to the warmer climates. Therefore I will try to restrict my discussion to the plants of the alpine areas of New Zealand, a group which deserves to be better known here.

New Zealand is a long and narrow country in the South Pacific, situated well over 1200 miles southeast of Australia. It comprises two large and several smaller islands covering approximately 1000 miles between latitudes 34° and 48°, roughly comparable in latitude to our own West Coast. The volcanic peaks in the center of the North Island rise to 9000 feet, while the more lofty Southern Alps which extend the length of the South Island rise to over 12,000 feet, with many peaks over 10,000 feet. Long isolation and a variety of climates

have helped give rise to a flora of which 75 per cent is endemic to New Zealand.

To a large extent much of the native covering of New Zealand has been destroyed and the land put over to agriculture or pasturage but there are many areas, especially at the higher elevations, where the vegetation has been relatively undisturbed. Most of primitive New Zealand was covered by a sub-tropical rain forest which extended up onto the moist slopes of the mountains. In drier areas, large tracts of nearly pure stands of southern beech (*Nothofagus*) are found. The rolling hills east of the Southern Alps were clothed with perennial tussock grasses, but most of this land has now been turned over to agriculture. At the upper limit of the forests, from 3000 to 4000 feet, there is a zone of sub-alpine scrub composed of various evergreen shrubs. Above this comes the alpine flora of small shrubs, herbs, and low grasses.

A few generalizations can be made about the New Zealand flora as a whole. Most of the plants are evergreen and perennial. An exceedingly large number of the species found in New Zealand bear white flowers, so that the chief attraction of the flora is not bright flower coloration, but rather a variety of plant habit, fruit color, leaf color, texture and shape.

One of the most interesting features of the

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alpine flora, especially of the South Island, is the abundance of cushion-plants which literally carpet the ground in hues ranging from deep green to bronze to silver. The members of the genus *Raoulia* (*Compositae*) form silvery or green mats on the stony river beds or on cliffs, and bear a profusion of creamy or whitish flower heads in summer. *Raoulia eximia* forms large, compacted greyish cushions from a few inches to two feet high in old plants. Other cushion-plants include *Drapetes Dieffenbachii* (*Thymelaeaceae*), the remarkable *Gentiana divisa* which resembles a snowball when in flower, members of the genus *Haastia* (*Compositae*), including *H. pulvinaris*, one of the great woolly "vegetable sheep," and *Ourisia caespitosa* (*Scrophulariaceae*), a gem bearing sheets of white flowers. To these one might add *Phyllachne clavigera* (*Stylidiaceae*), reputedly difficult to grow, *Scleranthus biflorus* (*Caryophyllaceae*), and the curious *Dracophyllum muscoides* (*Epacridaceae*). Numerous members of the *Compositae* are represented in the alpine flora of New Zealand. *Celmisia* is a genus of about 60 species and forms a conspicuous element of the montane flora, various species often carpeting the mountain slopes with their large, white, daisy-like heads. The cushion habit is found in this genus, too, as in

C. argentea, *C. Hectori*, and *C. parva*. *Celmisia coriacea* and *C. Hookeri* are large plants bearing rosettes of long, stiff, silvery leaves and heads up to four inches in diameter. *Celmisia spectabilis* is similar in aspect to these but smaller, and is abundant in mountain herb-fields of both islands. *Celmisia Armstrongii* and *C. Petriei* are handsome plants with narrow, dagger-like leaves. *C. Haastii* and *C. hieracifolia* are striking low plants with white tomentose leaves and small heads. Hybridism seems to be common in this genus, and some of the hybrids are quite handsome.

Two widespread and closely related genera of the *Compositae* are *Gnaphalium* and *Helichrysum*, whitish trailing or bushy plants bearing everlasting heads. *Leucogenes Leontopodium* and *L. grandiceps*, North and South Island edelweiss, are beautiful silvery suffruticose herbs which bear a striking resemblance to the European edelweiss, *Leontopodium alpinum*, although the structure of the flower heads is quite different. There has been little success with the cultivation of *Leucogenes* in New Zealand.

Olearia is a large genus of shrubs which possess a great value for garden decoration, second only to *Hebe*. Most of the alpine species bear numerous, small, whitish, daisy-like heads, so that beauty of form is their chief attribute. Of the upland forms, *Olearia arborescens* is a charming shrub with coriaceous ovate leaves which have a satiny tomentum underneath. *O. Haastii*, a small shrub with oblong leaves, is uncommon in nature but is frequently seen in cultivation. *O. cymbifolia* and *O. moschata* are others of the small-leaved montane species. *Olearia ilicifolia* is a handsome, musk-scented shrub with deep-green, leathery, toothed leaves. It and other olearias form a dense scrub just above timberline, so dense as to be literally impenetrable. The razor-sharp leaves of many of the species demand that the seed collector wear thick gloves if he is to work amongst them.



Pachystegia insignis, a handsome shrubby composite from the South Island.

(Fig. 8)

—PHOTO BY A. P. DRUCE,
WELLINGTON, N. Z.

In New Zealand there is a large number of woody members of the genus *Senecio*. These are quite similar in form to the olearias, and in general their culture is the same. Of the high mountain species, *Senecio cassinioides* is one of the best. It is a large shrub with small, aromatic leaves and bears masses of deep yellow flower heads. *S. revolutus* is an interesting prostrate shrub which creeps over stony ground in dry areas of the South Island. *S. laxifolius* is a low shrub of upland areas and has attractive whitish leaves and bright yellow heads. It is frequently confused in horticulture with the more handsome lowland *S. Greyii*, (fig. 9) which is likely less hardy than *S. laxifolius*. Of special interest, although it is not an alpine, is *S. Kirkii*, a symmetrical shrub which frequently perches as an epiphyte on trees in the dark North Island forests. It has glossy, dark-green leaves and becomes covered with a profusion of snow-white flower heads.

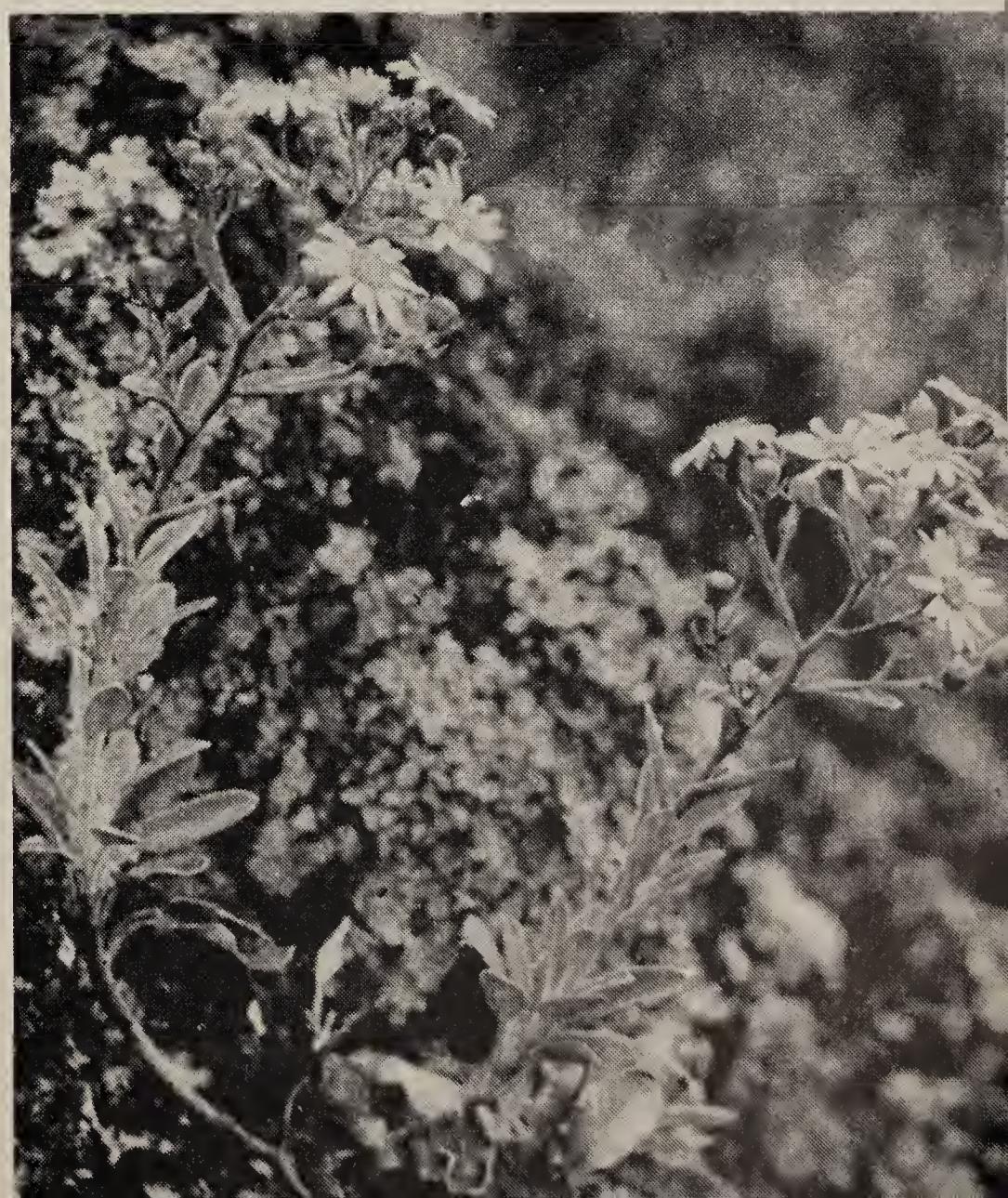
Pachystegia insignis is a singularly attractive plant which deserves more attention than it has been given in the past. It is a low, straggling shrub with large grey leaves, shining above and tomentose beneath. Younger portions of the stems are also clothed with this thick tomentum. The long, stout peduncles each bear a single hemispherical head with many crowded white ray-florets and yellow disc-florets. This species grows on dry cliffs in the northeastern part of the South Island, and seems to adapt well to cultivation, at least in many parts of New Zealand. (fig. 8).

The *Epacridaceae*, a family related to the *Ericaceae*, has many species of horticultural worth. The genus *Cyathodes* contains an array of shrubby species with needle-like leaves and showy red or white fruit. *Dracophyllum Menziesii* is an interesting small, much-branched epacrid which bears panicles of large, waxy-white flowers amongst the clusters of recurved, Agave-like leaves borne at the tips of stubby branches. *D. Urvilleanum* is a taller, but

smaller-flowered species with long graceful leaves resembling pine needles. *Leucopogon Fraseri* is a dwarf, much-branched shrub attractive not only for its single, sweet-scented flowers, but also for its large, translucent orange drapes borne in abundance. Only two genera of the *Ericaceae* are represented in New Zealand; one or two small pernettyas and some gaultherias. *Gaultheria depressa* is a highly variable species, some varieties of which form wiry mats on which the relatively large white or red fruits are copiously borne. Perhaps the most handsome *Gaultheria* in New Zealand is *G. oppositifolia*, from the volcanic plateau of the North Island. It is a low, branched shrub with large, shining, opposite leaves and great panicles of white flowers. It may not be fully hardy, but it should certainly be tried.

There are at least 45 species of *Coprosma* (*Rubiaceae*) native to New Zealand, varying in habit from cushion-plants to good-sized trees. The flowers of this genus are inconspicuous, but the foliage and fruit are frequently handsome. One of the best of the low species is *C. brunnea*. I will never forget my first sight of it on the bed of the Waimakariri river in the Southern Alps. The yellowish tangled stems covered several square feet of

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Senecio Greyii, a cliff-dweller from the North Island.

—PHOTO BY A. P. DRUCE,
WELLINGTON, N. Z.

(Fig. 9)



Abies amabilis at Low Divide, Olympic Mts.

(Fig. 10)

—PHOTO BY B. O. MULLIGAN

Pacific Silver Fir

Abies amabilis (Dougl.) Forbes

C. FRANK BROCKMAN

THIS SPECIES, the most common of the true firs native to the State of Washington, is found in the Olympics and Cascades at elevations varying from about 1,000 to 5,000 feet; its complete geographic range embraces an area from coastal southeastern Alaska on the north to the southern Oregon Cascades.

It is a tree of great beauty with lustrous dark green foliage. Individual needles are generally flat, vary in length from $\frac{3}{4}$ to $1\frac{1}{2}$ inches, are silvery white (stomatiferous) on the under side and, like all true firs, leave a distinctive round leaf scar when they drop or are pulled from the twig. In addition, they grow from the top as well as the sides of the branches and thus obscure the twig from view. This feature of the foliage readily distinguishes the Pacific silver fir from the grand fir, one of the common associates at the lower part of its altitudinal range. Foliage of the grand fir grows only from the sides of the branch, so that twig and foliage appear not unlike "hair parted in the middle." And since the foliage of the Pacific silver fir is stomatiferous only on the lower surface, it may be quickly distinguished from that of the two other true firs native to Washington—noble fir and alpine fir. The foliage of both these species has stomates on all surfaces, as a casual examination with hand lens or magnifying glass will indicate. Further, individual needles of noble fir—especially those on the upper branches—are usually plump in cross section rather than flat, as are the needles of the Pacific silver fir.

Cones of the Pacific silver fir are also distinctive. In common with all true firs they stand erect on the branches and disintegrate on maturity. They are further characterized by a length of from $3\frac{1}{2}$ to 6 inches, a form

which is cylindrical or "barrel-shaped," and a deep purple color. Alpine fir cones, while purple, are much smaller and of a different shape; grand fir cones are green and slightly smaller than those of Pacific silver fir; noble fir cones differ from those of the Pacific silver fir in their larger size, their columnar form, and the presence of numerous, overlapping green bracts which extend from between the scales to cover the cone of the noble fir like shingles on a roof.

Another distinctive feature of the Pacific silver fir is its bark which, even on large trunks, retains an essentially smooth appearance, typified by irregular gray to chalky-colored patches and resin blisters. Although larger specimens are found, mature specimens average from two to four feet in diameter and from 140 to 160 feet in height. (fig. 10).

Although the wood of the Pacific silver fir is not of high quality for lumber it is widely used in the manufacture of paper pulp. Increasing quantities of this species are being cut in the Puget Sound region to supply the needs of local paper mills. In addition, the development of epidemic infestations of a small beetle—with the generic name of *Pseudohylesinus*—which destroys this species by girdling in the cambium layer, has also accelerated logging in Pacific silver fir stands in the Cascades. Since the Pacific silver fir is not a long-lived tree, and this insect attacks older trees of weakened vitality, much of this logging is, in effect, a salvage operation.

The beautiful spire-like crown typical of the Pacific silver fir, together with its lustrous, dark green foliage, are exceptionally well-adapted to landscape decoration. Although widely used in Europe for that purpose it is not often found in local parks and gardens. Residents of the Puget Sound region should become better acquainted with this tree's singular beauty.

This is the twelfth in our series of articles on trees native to the northwest.

The Olympic Rain Forest

GRANT W. SHARPE*

EVERY American national park preserves some fundamental feature which distinguishes it from other national parks, and only one of its kind is preserved. Every national park was founded on this concept and preserves its unique feature in the form of an outdoor museum. Olympic National Park, on the Olympic Peninsula in Western Washington, is such a museum. The park includes within its boundaries a rugged wilderness of mountains, glaciers, seascapes, wildlife and forests. Individually all of these features are found in other national parks. What then is Olympic's unique feature? The title has already given it away—the rain forest. Most of the national parks have forests but none possesses one like that found on the west side of the park in the lowland river valleys. A mild climate, gentle topography, and centuries of abundant rainfall—the highest in the United States—combine to make this forest unique.

In these ocean-facing valleys of the park the four major coniferous species of the Pacific Northwest attain their maximum development. The striking feature of these wet lowland forests, in addition to the tree sizes, is the luxuriantly developed epiphytic vegetation (plants which grow upon other plants, not as parasites, but deriving moisture and nutrients chiefly from the air). These epiphytes, mainly mosses, liverworts, and lichens, are found upholstering the trunks and crowns of all trees. The tree size and epiphytic growth is attributed largely to the rainfall so let's consider the reason for the abundant rainfall at this time.

The amount of rain that falls on a mountain mass is usually dependent on the latter's proximity to an ocean. The closer a mountain mass is to the ocean, the greater will be the pre-

cipitation. The moisture, derived from the ocean, is carried landward by the prevailing winds. This cold Olympic land mass (whose highest point is only 32 airline miles from the Pacific) acts as a barrier, forcing the warm, moist air from the southwest to rise and condense. Moisture is extracted to such an extent on the windward side that little is left for the lee slopes. It is seen from this that the amount of rainfall varies within a mountain area. Along the coast rainfall reaches 90 inches annually. Further inland, in the west side river valleys (the Bogachiel, Hoh, Queets and two forks of the Quinault) the annual rainfall varies from 130 to 160 inches.† It is in these undisturbed valleys of Olympic National Park that the unique rain forests exist.

The effectiveness of the Olympic Mountains as a moisture barrier is better understood when one realizes that 33 miles from the wettest part of the United States, a limited rainfall makes irrigation a common practice. Rainfall at the town of Sequim, for example, on the lee or sheltered side of the Olympics, is less than 18 inches annually.

What effect does this heavy rainfall have on the vegetation of the rain forest valleys? The tree sizes have been mentioned only briefly. The floors of the rain forest valleys are clothed chiefly with conifers. The most abundant species is Sitka spruce (*Picea sitchensis*) which occurs in both pure and mixed stands with other conifers. It frequently attains heights up to 300 feet although the average more closely approaches 220 feet. The average DBH‡ is nearly six feet. One Sitka spruce, the largest ever recorded, has a 15-foot DBH and is located on the Hoh River, 10 miles inside the park boundary.

Western hemlock (*Tsuga heterophylla*) is

*Mr. Sharpe has worked as Park Naturalist at Olympic National Park during the summers of 1952 through 1955. During this period much time was spent by him in conducting a study of the Olympic Rain Forest. He is co-author with Mrs. Sharpe of "101 Wildflowers of Olympic National Park."

†Total annual precipitation in the Olympics reaches over 220 inches; however, this occurs only at high altitudes where severe conditions permit no trees to grow.

‡Diameter at breast height, 4½ feet above ground.

the second most common rain forest conifer. It, too, occurs in pure form or mixed with other conifers. Although the largest recorded hemlock is 9 feet DBH, located near Enchanted Valley on the East Fork of the Quinault River, the average hemlock DBH is only 30 inches. A four-foot DBH is common, but so is one of 15 inches. Heights average 150 feet, but often reach 200.

Douglas fir (*Pseudotsuga Menziesii* [*taxifolia*]) and Western red cedar (*Thuja plicata*) complete the conifer list. Douglas fir is found on well-drained benches and side slopes. This species only occasionally forms pure stands on the valley floors. More often isolated species occur with spruce and hemlock. Its average DBH is 7 feet 6 inches, and its height 255 feet. Occasional trees reach 300 feet. The record tree is located on the Queets River. Its DBH is over 17 feet.

Western red cedar is the least common of the conifers. In the rain forest it occurs only as isolated specimens and has an average diameter of 7 feet 6 inches. Heights average 142 feet. Further west in the poorly drained areas it grows in pure stands. Two cedars in the park are 20 and 22 feet in DBH.

Big leaf maple (*Acer macrophyllum*) is the most striking of the rain forest deciduous trees. It commonly occurs in groves. Average height is 90 feet, DBH 30 inches. Its noteworthy feature is the luxuriant plant growth found on its trunk and its crown.

Red alder (*Alnus rubra*) is the most abundant of the hardwoods and occurs in large stands along the river bottoms. Isolated trees do occur as relicts among the conifers. Heights and diameters are small. The DBH averages 16 inches, height 95 feet.

Black cottonwood (*Populus trichocarpa*) is also found along the rivers, usually mixed in red alder or conifer stands. The average DBH is 42 inches although diameters over 70 inches have been taken. Heights average 146 feet, frequently reaching 180 feet.

Vine maple (*Acer circinatum*) occurs everywhere in the rain forest, especially in the conifer stands, as an understory shrub. Pure

stands are common where it is of sufficient size to be classed as a tree.

There are fifteen species of shrubs, the most common being red whortleberry (*Vaccinium parvifolium*) and blue whortleberry (*V. ovalifolium*), which grow to 15 feet tall. Five ferns are represented here. Western swordfern (*Polystichum munitum*) is the most common, occurring on soil everywhere. Licorice fern (*Polypodium vulgare*) is common on big leaf maple trunks and crowns. It also grows in conifer crowns, some specimens occurring 270 feet above ground. A close relative to the ferns is *Selaginella oregona*, a club moss which reaches its maximum development on trunks and crowns of big leaf maple.

Grasses, sedges, and rushes total 28. Common grasses include *Bromus sitchensis*, *Trisetum cernuum*, *Deschampsia caespitosa*, two *Poa* and two *Agrostis* species. The most common sedge is *Carex brunneoscens*. *Luzula parviflora* is the common rush.

Herbs other than the grasses and grass-like plants total approximately 75 in number. Preferences for the soil beneath either conifers or deciduous trees is noticeable in this group of plants. Space does not permit listing all of the plants; however, here are some of the more common. Oregon oxalis (*Oxalis oregona*), trefoil foamflower (*Tiarella trifoliata*), sweetscented bedstraw (*Galium triflorum*), catchweed bedstraw (*G. aparine*), Western springbeauty (*Claytonia sibirica*), beadrush (*Maianthemum dilatatum*), American adenocaulon (*Adenocaulon bicolor*), youth-on-age (*Tolmiea Menziesii*), and common selfheal (*Prunella vulgaris*). A notable example of a plant preferring a certain tree type is the trailing raspberry (*Rubus pedatus*), very common over the ground and on logs in conifer stands but almost entirely lacking under hardwoods.

What is lacking in species of ferns is made up by the conspicuous bryophytes, the name given to the mosses and liverworts. These seedless plants total 71 and 30, respectively. Here again one notices a preference not only for particular tree types but for specific locations on the trees as well. Mosses abundant

on the ground and on logs include *Rhytidadelphus loreus*, *Eurhynchium oreganum*, *Hyplocomium splendens* and *Plagiothecium undulatum*. *Mnium insigne* is especially abundant on the soil in hardwood stands. Trunk mosses include *Hypnum circinale*, *Dicranum fuscescens*, *Hypnum subimponens*, and *Pseudoisothecium stoloniferum*. Big leaf maple trunks support *Neckera Menziesii*, the crowns *N. Douglasii*. Other crown species include *Pseudoisothecium stoloniferum*, and *Antitrichia curtipendula*. *Orthotrichum Lyellii* var. *papillosum* and *Ulotia obtusiuscula* show a distinct preference for the crowns of black cottonwood and red alder.

Of the liverworts on conifer trunks *Scapania Bolanderi* is the most abundant. A small liverwort, *Douinia ovata*, grows in conifer crowns on the underside of limbs, found on occasion over 280 feet above ground. The most robust of the liverworts is *Porella navicularis* which occurs on hardwood trunks and crowns. *Fuliginea nisquallensis* has a preference for red alder crowns. The greatest number of liverworts occur on the sides of rotting logs. The most common include *Riccardia latifrons*, *Calypogeia trichomanis*, *Cephalozia bicuspidata*,

C. media, *Lophozia incisa*, and *Scapania Bolanderi*.

Lichens show the greatest preference of all rain forest plants for a particular habitat. Limited space, however, does not permit listing any of these 70 lichens here. A visitor in search of foliose lichens will see only two species if he looks no higher than the ground. The other 30 occur in the tree crowns.

An interesting note on lichens is that over 30 of one form or another (crustose, foliose, or fruticose) occur in red alder and black cottonwood stands, yet less than half that number occur on maples. Lichens, it seems, compete unfavorably with the mosses in the maple stands.

During the taxonomical-ecological study of the rain forests within Olympic National Park the author found over 300 different species of plant growth between 500 and 1000 feet elevation. Several of these species have never before been recorded in the State of Washington.

Below:

The author in the Hall of Mosses, Hoh Valley,
Olympic National Park.

(Fig. 11)

—PHOTO BY G. W. SHARPE



Interested readers will find a complete list of all rain forest plants in the author's doctoral thesis in the library of the College of Forestry, University of Washington.

A story of the Olympic Rain Forest would not be complete without explaining how conifers get their start. Seeds of conifers germinate everywhere on the forest floor, but competition from mosses and other plants seems to eliminate any chance for their survival. Those germinating on rotting logs, however, do survive. Let us take a typical log. Its surface becomes covered with hundreds of seedlings. As the years pass, competition among the seedlings eliminates the less hardy. In 50 years probably not more than 15 seedlings survive. These survivors have long since sent their roots out around the log and down to mineral soil. One can look elsewhere in the forest to see this scene as it would look 200 years later. The survivors are growing in a straight line, and the rotting log or "nurse tree" is still there (fig. 12). Two more centuries, and the surviving trees will have increased their diameters greatly. The nurse log may or may not be completely decom-

posed. If it is decomposed the trees of the colonnade will appear to be standing on stilts (the roots once sent around the log to mineral soil). With time these roots will enlarge and fill in the space left by the now disintegrated nurse log. These colonnades are common in the rain forest, and the Sitka spruce is especially noted for its huge swollen base.

The observant visitor to the rain forest will frequently find a sphagnum moss. Elsewhere its normal habitat is in bogs. The heavy rainfall here, however, permits its growth not only on the ground, but on logs as well. This is one of the rain forest's most remarkable features.

The term "jungle-like" is often applied by popular writers to the Olympic rain forest. The canopy of the forest is dense, and there are at least 104 known species of plants living on the trunks and in the crowns of the trees. Yet this does not constitute a jungle. On the contrary, the forest floor itself is actually open and park-like. This would not be the case if

(Continued on Page 111)

Below:

A moss-covered nurse log between two Western hemlocks.

(Fig. 12)

—PHOTO BY G. W. SHARPE



Testing Barberries for Resistance to Stem Rust¹

RALPH U. COTTER *

IN 1865, Anton de Bary (1) established the fact that barberry serves as the alternate host of black stem rust, and this fact has been repeatedly corroborated by other workers. Hundreds of spreads of rust from barberry to wheat, oats, barley, and rye fields have been recorded in the United States since 1918. In one such spread in Indiana (10) it was estimated that \$50,000 damage was done to grain by stem rust, which originated on a single barberry bush.

In 1927 and 1928, Craigie (2, 3) proved that mixing the exudate of several pycnia results in the formation of aecia beneath these pycnia. In 1930, Stakman, *et al* (12) and Newton, *et al* (8) presented evidence of the origin of physiologic forms of stem rust through hybridization on the barberry. Additional contributions to this subject came later, all of which show that, coincident with the development of rust on the barberry, new races of the fungus are produced by hybridization of existing races. The races are designated by number and vary in their ability to attack different varieties of grain. Their importance has been demonstrated recently by races such as 15B of wheat stem rust and 7 of the oat stem rust. These races were first found in rust samples taken from the barberry and for a number of years thereafter only in barberry-infested territory. In those areas they build up and eventually spread throughout the important grain-growing areas of the United States and Canada. These races have since been responsible for losses amounting to hundreds of millions of bushels of small grain.

Thus the importance of susceptible species of barberry, mahonia, and mahoberberis to the stem-rust control problem has been definitely established. When the barberry-eradica-

tion program was started in 1918, the objective was to eliminate the common barberry (*Berberis vulgaris*). Surveys to determine the prevalence and distribution of this species of barberry showed that there were a large number of species of barberry, quite a few of mahonia, and at least one species of mahoberberis in the area. At that time it was not known whether all of these were susceptible to stem rust.

Source of Material

An effort has been made to test all the species and varieties currently in commerce in this country. Fewer species of barberry now are being sold by nurseries than was the case 20 years ago, because many of the bushes then offered for sale were susceptible to stem rust. State and/or Federal legislation now regulates the shipment of all resistant barberry and mahonia species and the interstate movement of susceptible stock is prohibited.

The species and varieties of barberry and mahonia found in the United States came primarily from nurseries in this country, although some were imported from other countries, particularly Europe. Most of the imported species were found to be susceptible to rust. Others were native species, such as the mahonias, which, as a class, tended to be resistant. Most of these came from the West and Southwest and were natives of dry, arid country. The four known species of mahoberberis are crosses between the *Berberis* and *Mahonia* genera.

Many so-called barberry species or horticultural varieties are hybrids or crosses between two species. When both parents are resistant, the hybrid usually is resistant to stem rust. However, if one parent is susceptible, it might well be assumed that some of the progeny would be susceptible. An example is *B. ottawensis*, a hybrid between *B. vulgaris* and *B. Thunbergii*. When the plant characters of the hybrid indicate that one of its parents might be susceptible, it is desirable that some of the seedlings from the hybrid be made

*Dr. Cotter is associated with the Plant Pest Control Branch, Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the Minnesota Agricultural Experiment Station.

1. Published with the approval of the director, Minnesota Agricultural Experiment Station.

available for testing. The Sheridan red barberry is a good example of a hybrid where the F-1 was highly resistant, but some of the plants grown from the seed of this hybrid were highly susceptible.

Method of Testing

Information was gathered quickly on the more susceptible species, which were found to be infected in nature in such places as Highland Park, Rochester, New York; the Arnold Arboretum of Harvard University; and gardens such as N. E. Hansen's experimental plots at Brookings, South Dakota (5). Many of these species rusted heavily in nature, but it was necessary to test others by artificial methods under greenhouse conditions. This method of testing consists, essentially, of control over such factors as heat and moisture, and prolonged exposure of the barberry to infection under favorable conditions.

Another important feature is that indoor testing of barberry be done with known inoculum. It is desirable that any species, variety, or hybrid be tested with teliospores of several varieties of stem rust, particularly with the teliospores of the three varieties of stem rust that occur on wheat, rye, and oats (*Puccinia graminis tritici*, *P. graminis secalis*, and *P. graminis avenae*). While there is no evidence that any species or variety of barberry or mahonia may be susceptible to one of these rust varieties and not to the others, it is preferable to use telia of more than one variety of stem rust. Most of the barberries tested at the Cooperative Rust Laboratory, St. Paul Campus, University of Minnesota, were inoculated with telial material obtained from wheat and oats, which comprised many races of the fungus. Rye telial material was used when available.

The plants selected for testing at the Cooperative Rust Laboratory should be uniform for botanical characters, conform to the description for that species, be small enough to be handled easily in the tests (less than a foot high), and vigorous enough to leaf out readily in the greenhouse. Six plants of a given species is considered the minimum number adequate for testing, although more would be desirable.

The dormant plants are potted and placed in the greenhouse to become established. When they leaf out during the cooler months, they are placed in an incubator in a cool room (about 17 degrees C). Each incubator holds five to six plants, one of which is known to be susceptible to rust. A wide-meshed screen is suspended over the plants, and straw bearing viable teliospores of stem rust is placed thereon. This straw is sprinkled with water each evening for a week, with the cover being replaced each time. The inoculated plants are placed in the greenhouse, where after an interval of five to ten days, the rust appears on the susceptible plants as small orange spots on the upper side of the leaves. This process is repeated with a second series of five to six plants, if available. (fig. 13).

The first rust infection that appears on the barberry is the pycnial stage, and it is in this stage that hybridization of the rust may occur.

The pycnia are followed about a week later by the aecia, which are small, orange-colored, cup- or horn-like structures on the lower side of the leaves. These contain the aeciospores,

Below:

Berberis vulgaris (susceptible). Note rust infection on leaves (insert). Most barberries with spiny-edged leaves are susceptible to stem rust.

(Fig. 13)

—PHOTO COURTESY OF DR. COTTER



which infect susceptible grains and grasses, producing the urediospores, or red spores. This red or summer stage of the stem rust is the destructive stage of the fungus.

Reaction of Barberries

The reaction of barberries to stem-rust infection varies from complete immunity to complete susceptibility. Part of this seems to be due to the thickness of the cell wall of the leaves, as shown by Melander (6) and Melander and Craigie (7). There are fewer susceptible barberries in the thick-leaved evergreen *Berberis* and *Mahonia* groups than in the deciduous barberries, which have thinner leaves. But these morphological differences in leaf structure are not the sole reason for differences in susceptibility, as there are some thin-leaved *Berberis* species, such as *B. Gilgiana* and *B. koreana*, which have considerable resistance to stem rust. The age of the leaves plays a part in the reaction of the plant to the rust fungus. Leaves of the common barberry are very susceptible up to the age of 12 days, with lessening infection up to 16 days (4). Leaves of the evergreen barberries and mahonias do not remain susceptible nearly so long. Once inside the leaves of the common barberry, the rust can remain alive for nearly a month in the spring and endure temperatures down to freezing. It will continue its normal life cycle when conditions become more favorable for its growth (4).

Some authorities recognize three genera of *Berberidaceae* which rust, namely, *Berberis*, *Mahonia*, and *Mahoberberis*. The genus *Berberis*, whose species have spines and fascicled leaves, contains the larger part of the susceptible barberries. The mahonias, with unarmed stems and compound leaves, are in general somewhat resistant to rust. The genus *Mahoberberis* has both simple and compound leaves. *Mahoberberis Neuberti* is highly susceptible but *Mahoberberis Miethkeana* is resistant. Both apparently are sterile, although a few infertile berries have been found on the latter species. Within the *Berberis* section there are two groups of plants, the deciduous and the evergreen-leaved barberries. Most of the sus-

ceptible species are deciduous-leaved, but the evergreen-leaved species usually are resistant in varying degrees. Some of the evergreen-leaved barberries, such as *B. Chenaultii* and *B. Sargentiana*, have been immune in the tests made; others, like *B. Julianae*, *B. Gagnepainii*, and *B. formosana*, have in a few tests been very lightly infected; and a few species like *B. atrocarpa*, *B. chrysophaera*, *B. Knightii*, and *B. laevis* readily become infected. Both the evergreen-leaved *Berberis* and the mahonias probably owe their resistance to their thick, leathery leaves, which are too tough for the rust to invade readily, as in the case of *B. Julianae* and *Mahonia repens*.

Extent of Tests

The present-day knowledge of the susceptibility of various species of barberry is the result of work done by a number of investigators. In 1923, Stakman and Levine (11) compiled a list of susceptible and resistant barberries, and this was followed by supplementary lists by Melander and Lambert in 1923 (in 4) and by Melander in 1924 (6). This material was gathered together and added to by Cotter (4) and Levine and Cotter (5) in 1932. Since that time, up-to-date lists have been issued by the U. S. Department of Agriculture as a result of additional tests made by the author. The latest (1955), published by the Plant Pest Control Branch, U. S. Department of Agriculture (9), lists the following species and varieties as resistant:

Scientific name:	Scientific name:
<i>Berberis arido-calida</i>	<i>B. stenophylla nana</i>
<i>B. Beaniana</i>	<i>compacta</i>
<i>B. buxifolia</i>	<i>B. telomaica artisepala</i>
<i>B. buxifolia nana</i>	<i>B. Thunbergii</i>
<i>B. calliantha</i>	<i>B. Thunbergii atropurpurea</i>
<i>B. candidula</i>	<i>B. Thunbergii atropurpurea nana</i>
<i>B. Chenaultii</i>	<i>B. Thunbergii erecta</i>
<i>B. circumsererrata</i>	<i>B. Thunbergii "globe"</i>
<i>B. concinna</i>	<i>B. Thunbergii "golden"</i>
<i>B. Darwinii</i>	<i>B. Thunbergii Maximowiczii</i>
<i>B. formosana</i>	<i>B. Thunbergii minor</i>
<i>B. Franchetiana</i>	<i>B. Thunbergii pluriflora</i>
<i>B. Gagnepainii</i>	<i>B. Thunbergii "thornless"</i>
<i>B. Gilgiana</i>	<i>B. Thunbergii "variegata"</i>
<i>B. Horvathii</i>	
<i>B. hybrido-gagnepainii</i>	
<i>B. insignis</i>	
<i>B. Julianae</i>	
<i>B. koreana</i>	
<i>B. Lempergiana</i>	

<i>B. lepidifolia</i>	<i>B. Thunbergii xanthocarpa</i>
<i>B. linearifolia</i>	<i>B. triacanthophora</i>
<i>B. linearifolia</i> var. Orange King	<i>B. verruculosa</i>
<i>B. lologensis</i>	<i>B. virgetorum</i>
<i>B. mentorensis</i>	<i>B. xanthoxylon</i>
<i>B. pallens</i>	<i>Mahoberberis Miethkeana</i>
<i>B. Potaninii</i>	<i>Mahonia Aquifolium</i>
<i>B. Renton</i>	<i>M. Bealei</i>
<i>B. replicata</i>	<i>M. compacta</i>
<i>B. sanguinea</i>	<i>M. dictyota</i>
<i>B. Sargentiana</i>	<i>M. Fortunei</i>
<i>B. stenophylla</i>	<i>M. lomariifolia</i>
<i>B. stenophylla diversifolia</i>	<i>M. nervosa</i>
<i>B. stenophylla gracilis</i>	<i>M. pinnata</i>
<i>B. stenophylla Irwinii</i>	<i>M. repens</i>

These may be moved interstate in compliance with the provisions of the Federal Black Stem Rust Quarantine No. 38.

In the susceptible list there are 120 species and varieties, plus 35 synonyms. Over 100 of these belong to the *Berberis* group, and the majority of them are barberries which were in commerce 25 or more years ago and are seldom encountered now.

Discussions and Conclusions

The program carried on during the past 30 years to test barberry, mahonia, and mahoberberis species has eliminated from commerce a large number of susceptible species, varieties, and hybrids and has greatly reduced the possibility of susceptible species becoming reestablished in grain-producing areas. It has greatly reduced the number of species in trade channels and those now being offered for sale within the 19 barberry-eradication states.

Many of the barberries tested during the past five years have been seedlings of apparent hybrid origin. Because of the elimination of the susceptible species in the United States, these hybrids have, for the most part, proved to be resistant, since they were the result of crosses between resistant parents. Others were selections or strains from resistant species, such as the varicolored strains of *B. Thunbergii*; also the thornless and upright-habit strains. Plants grown from seed obtained from some foreign countries have been a problem because no information was available concerning the probable parents. Quarantine regulations now prohibit the importation of seed of any species of bar-

berry or mahonia. The urge to have something better or different will result in still more new varieties of barberry, and for this reason it may be necessary to continue the testing work for some time, in order to weed out those species which rust and thus are a menace to the small-grain crops.

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3.—On the occurrence of pycnia and aecia in certain rust fungi. Phytopathology 18: 1005-1015. 1928.
4. Cotter, Ralph U.—Factors affecting the development of the aecial stage of *Puccinia graminis*. U.S. Dept. Agr. Tech. Bul. 314. 1932.
5. Levine, M. N. and R. U. Cotter—Susceptibility and resistance of Berberis and related genera to *Puccinia graminis*. U.S. Dept. Agr. Tech. Bul. 300. 1932.
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7. Melander, L. W. and J. H. Craigie—Nature of resistance of Berberis spp. to *Puccinia graminis*. Phytopathology 17: 95-114. 1927.
8. Newton, Margaret, T. Johnson, and A. M. Brown—A preliminary study on the hybridization of physiologic forms of *Puccinia graminis tritici*. Scientific Agriculture 10: 721-731. 1930.
9. Popham, W. L.—Administrative instructions designating rust-resistant species and varieties of barberry, mahoberberis, and mahonia plants. P.P.C. 577, Rev. Part 301—Domestic Quarantine Notices; Subpart — Black Stem Rust. April 6, 1955.
10. Stakman, E. C., F. E. Kempton, and Lynn D. Hutton. The common barberry and black stem rust. U.S. Dept. Agr. Farmers' Bul. 1544: 10. 1929.

(Continued on Page 111)



Flowering branch of *Colletia armata*, November
10, 1955. Inset: Flowers, about twice natural size.
(Fig. 14)

—PHOTO BY DON NORMARK

New or Unusual Plants in the Arboretum

4. *Colletia Armata*

J. A. WITT

CHILE, that long, narrow country on the west side of South America, has furnished the Arboretum with some beautiful and useful plants. The Chilean Pernettya, *Pernettya mucronata*, is probably Chile's best-known contribution, but there are many others, including the unusual orange-flowered *Buddleia globosa*, several species of *Escallonia*, the flamboyant Chilean fire bush, *Embothrium lanceolatum*, and that fine evergreen barberry, *Berberis Darwinii*.

Perhaps some of the most unusual plants native to Chile growing here are the Colletias, of which *Colletia armata* is our best example. The Colletias are members of the Buckthorn family (*Rhamnaceae*), of which our native cascara, *Rhamnus Purshiana*, is a member. There is little similarity between *Colletia armata* and the cascara, save in the floral parts, but there is a definite family resemblance between it and some of the more spiny buckthorns such as *Rhamnus japonica* or *Zizyphus Jujuba*, the common Jujube.

Our two large plants of *Colletia armata*, now about six and seven feet high, were received as seed from the Royal Botanic Gardens, Kew, England, in April 1946, and were planted in their present location, north of the office and west of the rest rooms, in April 1952. In January 1953, the south plant flowered for the first time, then again in August of the same year. This year (1955) it flowered in mid-August, continuing until mid-September. To our surprise, it began flowering again the first part of November, and was in full flower when the freezing weather came November 12th. Its mate, the north plant, was in full bud at that time. (fig. 14).

The plant is a deciduous, spreading shrub ultimately to 12 feet, whose leaves are never much in evidence, and whose young shoots

consist of round, gray-green, stiff and thick spines set on other spines. These actually are the young branches, and carry the flowers and fruit. Each is tipped with a very sharp callus, giving the whole plant a most formidable aspect. The flowers, actually the calyxes for the petals are absent, are little waxen bells $\frac{3}{16}$ of an inch long and about $\frac{1}{8}$ inch broad, pale pink when in bud, changing to off-white when fully open. These are borne in clusters of twos or threes along the spines. They are carried in such profusion, however, that they cover the stiff lines of the bush, giving it a light, airy appearance. The flowers give off a very sweet perfume, much like that of the Hawthorn, and seem to be a prime favorite of the bees. On a warm day a flowering plant fairly buzzes.

The leaves, found only on the older wood, are very small, very few and soon lost. The twigs and stem carry on the necessary photosynthetic processes.

It requires a sunny location if it is to flower well, and a sandy, well-drained soil. It is quite hardy, having survived the winter of 1949-50 while still in the nursery, and a low temperature of 12° in the winter of 1953-54 in its present location. The plant to the north has been affected by a die-back which killed a number of shoots, but does not seem to be severe enough to do more than disfigure it.

It is native to southern Chile, in the provinces of Valdivia and Llanguihue, from where it was introduced into England in the early 1880's. The typical *C. armata* has a distinct down on the spines, which our plant lacks. We think that it is probably *Colletia armata* forma *subglabra*, a form described from a plant growing at Kew.*

Colletia armata is not a plant for every garden, but it is a most interesting oddity.

Plants of New Zealand in the University of Washington Arboretum

MRS. RAYMOND D. OGDEN*

In the University of Washington Arboretum are many plants whose original home is in far distant New Zealand, a group of islands in the southern hemisphere that reminded me a little of our Pacific Northwest. North Island, originally covered with forests of Kauri pine, is now a land of gently rolling hills and valleys split almost in two by a large volcanic and thermal area, devoted mainly to agriculture and dairy farms. The South Island, a mountainous land of snow-capped peaks, deep fertile valleys, large forests of southern beech, is now given over to cattle and sheep. There are many smaller islands of like topography.

The first interesting plants from these far islands, found near the Camellia collection on the upper south bank of Rhododendron Glen, is a group of *Hoheria glabrata*, a tree of the mallow family. It grows to a height of 30 feet, bears branches with oval leaves about five inches long, and white flowers followed by winged seeds. The larger tree flowered and fruited this year; it was raised from seeds received from a garden in northern Ireland in 1950.

In the oak section are a few specimens of southern beech, *Nothofagus*. As yet they are very small trees but at maturity should reach heights of 50-60 feet. *N. Menziesii*, "Silver Beech," has horizontal branches with brown hairs, leaves a shiny dark green, ovate, one-fourth to one-half-inch long. The "Red Beech," *N. fusca*, has downy branches, evergreen reddish brown oblong leaves, one to one and one-quarter inches long and deeply serrate. An alpine evergreen *N. cliffortioides*, with white bark, leaves one-quarter to one-half-inch long with grayish-white hairs underneath, is a third species here.

A small slender shrub at the west end of the greenhouse with very long narrow leaves,

*Mrs. Ogden is a member of the "Frances Macbride" Arboretum Unit (No. 41) and has just recently made a trip to New Zealand.

shiny green above and white and downy underneath, is *Corokia buddleoides*, a member of the Dogwood family, *Cornaceae*. It has yellow fragrant flowers but so far has not bloomed here and does not appear too happy in its location; it has also been planted near the south end of the Arboretum.

Near the Clubhouse are three small trees which at first glance look like cedars. They are *Phyllocladus alpinus*, the mountain celery pine. The pale yellow-green "foliage" is not true leaves but flat twigs clustered at the end of the branches. As the tree matures the branches bend down, touch the ground, root, and the tip rises again, forming another tree. Thus it "walks through the forest."

Podocarpus nivalis, on the rock wall behind the greenhouse, is a member of the pine family. It is densely branched with pale, light green, thick leathery leaves. The branches grow outward rather than upward, thus appearing to be continually cut down. They will root along the underside wherever the branches touch the ground. In its native land it grows at an altitude of 2,000-4,000 feet. Also on the rock wall is *Celmisia coriacea*. An herb, it has aster-like leaves 8-20 inches long, broad with deep longitudinal furrows, woolly at first above, white underneath. At times the flower stems will reach to 36 inches tall and the white flower heads to 4 inches wide.

Plants of ground-cover-type and questionable hardiness are found in the greenhouse and lath house. One of the most interesting is *Leucopogon Fraseri*, a member of the *Epacridaceae*. A small, erect, aggressive plant with close-set stiff leaves one-sixth to one-fourth-inch long with a very pungent odor. The flowers are large for the plant size, white, followed by an orange-colored drupe. To my mind, if found hardy, this would make an excellent ground cover. A member of the *Ericaceae* is *Gaultheria antipoda*, the New

Zealand Snowberry. It is quite low growing with oblong, red-tipped serrate leaves on rather scattered branches. An attractive little shrub with its brownish-red coloring and red or white fruits in September-October.

Some seedling plants of *Muhlenbeckia axillaris*, of the buckwheat family, with brown wiry stems and small tufted oblong leaves, are growing in a flat in the greenhouse.

Among the many varieties of fuchsias which almost seem to cover the roadsides as one drives through New Zealand is a slender semi-prostrate plant 6-8 inches high, *Fuchsia procumbens*. The flowers are solitary, tiny, blue and cerise, and with this unusual feature the pollen is blue.

Senecio laxifolius, a semi-prostrate shrub from the South Island, is similar to *S. Greyi*

which also comes from New Zealand but from the North Island and has larger leaves. It has practically taken over the corners by the garage door.

Two interesting plants behind the greenhouses are *Notospartium* and *Carmichaelia Ensyi* of the legume family. Except in very young plants they are leafless with whipcord-like, yellow-green branches. Flowers are pink or purplish, small and sweetly scented. The pods open and form a shield for the seeds which hang on the branches by a thread.

Probably one of the most abundant family of plants in New Zealand, with upwards of 100 species, are the veronicas (*Hebe* species) and our collection has a number of specimens. They range in leaf color from grey-green.

(Continued on Page 113)

Rooted Cuttings for *Cornus* Species

DR. FREDERICK W. COE*

MY EXPERIENCE with rooting different species of *Cornus* started as a fluke in the summer of 1954. During the first week in August I had made my last azalea cuttings of the season and had nearly filled the cold frame. As there was a little room left I thought of trying a few cuttings of a large bracted plant of *C. florida* growing nearby and also a few of a plant of *C. Nuttallii* brought from the lower San Francisco peninsula. I made cuttings of wood which was of good springy consistency, dipped the basal ends in Hormodin No. 2 and placed them in the half and half (by volume) mixture of peat moss and sand used in the cold frame. I had read that *Cornus* was difficult to propagate by cuttings and was prepared to see all of the cuttings die. Because of this firm belief I had only made three cuttings of each species.

After about two weeks, following our usual hot August weather, I noticed the cuttings looked healthy but had no idea that they were rooted. On testing them I found marked resistance on pulling on them. At the end of

two more weeks—that was near the middle of September—I dug them up and potted them. The roots at that time were four to six inches long. Overwintered in pots plunged in the cold frame, two of each species have grown well this summer.

This summer I decided to try all the species of *Cornus* that I had available. I again made cuttings of *C. Nuttallii*, this time from not only the peninsula plant but also another nursery-grown plant. Four cuttings of each plant were made. In addition I made six cuttings of *C. florida rubra* and *C. Kousa chinensis*. In two weeks all species were apparently rooted. One cutting of *C. florida rubra* and one cutting of the nursery-grown *C. Nuttallii* died, but the remainder rooted rapidly and profusely.

Next year I'll make a full scale trial and attempt to root a sufficient number of cuttings to get some accurate statistics on percentage of rooting.

Certainly if my experience holds, this is a much simpler way of propagating good forms of *Cornus* than grafting.

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Quality Plants Available in the Seattle Area

The following list was compiled, prior to the cold weather in mid-November, by an energetic member of Lake Washington Garden Club, for the information of her fellow-members. It was formed by visiting sixteen nurseries in this area and listing plants seen considered to be in this category. The original lists, however, contained a number of less hardy plants which have since been deleted on account of the abnormally cold weather in November. While this should be of assistance in locating these more unusual and less commonly available plants, at the same time it must be recognized (a) that for lack of time not every nursery in the area was visited, and (b) that some plants included in it may not now be available, or fit for sale, owing to the subsequent cold weather. With those limitations it is offered to our readers.

Sources for any of the plants listed can be obtained by enquiring from the office of the Arboretum Foundation (telephone MInor 4510).

Abies lasiocarpa
— *nobilis*
— — *glauca*
— *Pinsapo*
— — *glauca*
Acer griseum
— *pseudoplatanus Drummondii*
— — *Leopoldii*
Albizia julibrissin
Arbutus Unedo
Arcterica nana
Arctostaphylos columbiana
Bambusa pygmaea
Berberis triacanthophora
Camellia Sasanqua
— *Williamsii "J. C. Williams"*
— — "Mary Christian"
Campsis (red)
Caryopteris clandonensis
Ceanothus "A. T. Johnson"
— *gloriosus*
— "Marie Simon"
Cephalotaxus Harringtonia
Ceratostigma plumbaginoides
Cercidiphyllum japonicum
Chimonanthus praecox
Clematis Armandi
— *tangutica obtusiuscula*
Clethra alnifolia
Cornus florida pendula
— — *Welchii (variegated)*
— *Kousa*

Corylopsis glabrescens (Gotoana)
— *pauciflora*
— *platypetala*
— *sinensis*
— *spicata*
— *Willmottiae*
Cytisus Battandieri
Daboecia cantabrica Praegeri
Daphne Blagayana
— *Mantensiana*
— *retusa*
Daviddia involucrata
Distylium racemosum
Elaeagnus angustifolia
— *Ebbingei*
— *pungens*
— — (variegated)
Embothrium lanceolatum
— *longifolium*
Enkianthus campanulatus
Euonymus alatus nana
— *Maackii*
— *planipes*
— *radicans kewensis*
— *sanguinea*
Eucryphia intermedia
— *nymansensis*
Exochorda racemosa (grandiflora)
Fagus sylvatica asplenifolia
— *sylvatica aurea*
Forsythia "Arnold Dwarf"
Fothergilla monticola
Franklinia alatamaha
Gaultheria wisleyensis
Gaultheria adenothrix
— *cuneata*
— *Miqueliania*
— *nummularioides*
Ginkgo biloba
Halesia carolina
— *monticola*
Halimiocistus Sahucii
Hamamelis mollis
— — *brevipetala*
Hydrangea petiolaris
— *quercifolia*
Ilex Aquifolium ferox
— — *myrtifolia*
— *crenata Helleri*
Itea ilicifolia
Kalmia angustifolia
— *latifolia Dexter's strain*
— *polifolia*
Kerria japonica, dwarf variegated
Leucothoe Catesbaei
— *Davisiae*
— *Grayana glaucina*
— *Keiskei*
Ligustrum Delavayanum (ionandrum)
Magnolia Campbellii
— *denudata*
— *Kobus*
— *Lennei*
— *salicifolia*
— *Sargentiana robusta*
— *Sieboldii (parviflora)*
— *virginiana*
— *Wilsonii*
Mahoberberis Miethkeana
Mahonia Bealei

Malus Sargentii
Metasequoia glyptostroboides
Myrica pensylvanica
Nothofagus antarctica
Osmanthus Delavayi
 — *suavis*
Oxydendrum arboreum
Parrotia persica
Pernettya leucocarpa
 — *tasmanica*
Picea Englemanni
Pieris floribunda (from selected stock)
 — *japonica forma crispa*
Pinus aristata
 — *densiflora*
 — *Griffithii*
Prunus Hillieri (*incisa* x *Sargentii*)
 — *serrulata* "Ukon"
Quercus robur Concordia
 — — *fastigiata*
Raphiolepis indica rosea
Rhus Cotinus purpurea
Sarcococca confusa (*ruscifolia*)
 — *Hookeriana*
Sciadopitys verticillata
 — — large trees
Sequoia gigantea
 — *sempervirens*
Skimmia Foremanii
 — *japonica* (white berried form)
Stachyurus praecox
Stewartia pseudocamellia
 — *serrata*
Styrax japonica
Taxodium ascendens nutans (*pendulum*)
 — *distichum*
Ternstroemia japonica
Tsuga canadensis pendula
Vaccinium Delavayi
Viburnum bodnantense
 — *fragrans*
 — — *nanum*
 — *Juddii*
 — *odoratissimum*
 — *rhytidophyllum*
 — *tomentosum* v. *plicatum*
Xanthoceras sorbifolia
Wisteria sinensis (pink form)
 Dwarf conifers
 Rhododendrons, dwarf
 — hybrids
 — species

Testing Barberries for Resistance to Stem Rust

(Continued from Page 105)

11. and M. N. Levine—A partial report on the susceptibility and resistance of *Berberis* and related genera to stem rust. *Cereal Courier* (Office of Cereal Crops and Diseases, Bur. Pl. Indus., U.S. Dept. Agr.) 15: 278-287. 1923.

12. M. N. Levine, and R. U. Cotter. Origin of physiologic forms of *Puccinia graminis* through hybridization and mutation. *Scientific Agriculture* 10: 707-720. 1930.

The Olympic Rain Forest

(Continued from Page 101)

it were not for the fact that the Roosevelt elk winter in the valleys. Elk exclosures, established in 1932, substantiate this statement. Only in these exclosures does one see a virtually impenetrable jungle of vegetation.

To see typical yet undisturbed rain forest the author suggests the Hoh River road. Near the Hoh Ranger Station there is a one-mile self-guided nature trail, first opened in June 1955. The easy trail permits the park visitor to see many of the features outlined in this article. Highlight of this trail is the large grove of big-leaf maples which displays a prolific growth of epiphytes. This grove, The Hall of Mosses, was named by the author while in the employ of the National Park Service (fig. 11). Guide booklets written by Park Naturalist Gunnar Fagerlund are available at the beginning of the trail, and will add greatly to park visitors' understanding of this unique area.

Since the establishment of Olympic National Park in 1938, and even before this, these lowland forests have been the subject of much controversy between conservation groups and timber interests. To some, the application of the term "rain forest" to these lowlands inside the park is objectionable. They feel that to admit that these forests are unique would be inviting defeat.

What then is a "rain forest"? The term is usually applied to forests of the tropical zones having a heavy precipitation. Most tropical rain forests receive less than 100 inches of rain annually. It follows then that the Olympic rain forest with its 130 to 160 inches of rainfall is more truly a rain forest than the tropical forests to which the term is applied.

It is not inconceivable that this magnificent forest could be removed from the park. If you feel it is worth keeping, be on the lookout for legislation affecting it.

URGENTLY WANTED Arboretum Bulletins nos. 8 and 9—Volume I to complete set for binding.

The Arboretum Bulletin

VOL. XVIII, No. 4 SEATTLE, WASH. WINTER, 1955

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To keep memberships in the Arboretum Foundation in good standing, dues should be paid during the month payable. Active memberships more than three months in arrears will be dropped and THE BULLETIN will be discontinued.

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I hereby apply for membership in the Arboretum Foundation and remittance for same is enclosed to cover dues for the next succeeding 12 months.

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All memberships are non-assessable.

Notes and Comment

THE whole Pacific Northwest was severely affected by a mass of exceptionally cold air from northern Canada which moved into Washington on November 11 and remained there for almost a week. During this period there was no snow cover on the ground in the Arboretum, although a little fell at first during the onset of the cold front, and with strong north to northeast winds, the broad-leaved evergreen trees and shrubs suffered drastically from loss of moisture from their foliage.

It is too early at this date to properly assess the damage caused in the Arboretum, but it is easily seen amongst such groups as the camellias, rhododendrons, *Cistus* and *Hebe*, in the plantings around the Administration Building and greenhouses, and driving along the Upper Road. To give but one example: the whole bank to the north of Rhododendron Glen, facing west and planted with rhododendrons of the *Thomsonii* series, is now covered with dismal-looking, brown-leaved shrubs, with the sole exception of "Bow Bells" in the lower northwest corner.

From November 12 to 15, inclusive, the maximum day temperature varied from 24° to 28° F., while the minima were 16°, 15°, 10°, 11°, 13° and 17° respectively from the 11th to the 16th. While these figures were not as low or the cold period so prolonged as in January and February 1950, yet it seems probable, due to the earliness of this attack of winter weather and the fact that we had had no frosts previously this fall, that the damage to evergreen plants in the Puget Sound area may be more extensive and severe than it was at that time.

In order to form some estimate of the extent and amount of this damage the Editor of the *Bulletin* would appreciate receiving reports later from readers throughout the whole affected area, indicating what plants have apparently been killed, damaged severely, slightly, or have escaped harm. By this means we may discover some plants harder than imagined, or gain confirmation of damage to others in many different locations. If low

temperature figures are known for the particular site they should be included.

Reports can be published in the Spring issue of the *Bulletin* if received by February 1; for the summer issue the final date is May 1, 1956. Suitable pages for recording damage can be obtained from the Arboretum office on request.

The colored map of the Arboretum and its surroundings, enlarged to about twice the size of the printed edition, now hanging on the east wall in the Clubhouse, is a gift from the recently formed Broadmoor Unit No. 65.

This enlargement is the work of Professor John C. Sherman of the Geography Department of the University of Washington, and contains considerably more detail on plant groups than the smaller version. During the summer months it is planned to hang it outside the office door for the benefit of visitors, especially those at week ends when the office is closed.

CONIFER EXHIBIT

An exhibit of conifers was held in the Arboretum Clubhouse, November 16 through 19, which included a number of specimens taken from trees that will be removed when the approaches to the second Lake Washington bridge are put through. In all, some 53 cut branches, many with cones, were on display. These included members of 22 genera, of which the pines were best represented with 11 species. Among the more interesting and rare specimens were the tiger-tail spruce (*Picea polita*) from Japan; *Pinus Armandi* from China, a relative of our white pine; *Tsuga Sieboldii*, a lovely hemlock from Japan; *Cupressocyparis Leylandii*, a bigeneric hybrid between the Monterey Cypress and the Alaska cedar; and two species of *Podocarpus* from New Zealand.

Our western natives were not ignored. They included three species of the true firs, three of our native pines, two hemlocks, western red cedar, Douglas fir, and the Alaskan cedar.

Various Unit members were on hand to act as hostesses and guides throughout the exhibit. It was unfortunate that the display was

held during the worst November cold wave ever experienced in Seattle.

J. A. W.

NEW DIRECTOR

A recent article in the journal of the California Arboretum Foundation, Inc., Arcadia, California, announced the appointment of Dr. William S. Stewart as the new Director of the Los Angeles State and County Arboretum. Dr. Stewart will also serve as head of the Department of Arboreta and Botanical Gardens in Los Angeles County.

"Termed an 'outstanding horticulturist of the highest qualifications' by the Los Angeles County Board of Supervisors" Dr. Stewart was to assume his duties in September.

Plants of New Zealand in the U. of W. Arboretum

(Continued from Page 109)

whorls of one-quarter-inch leaves of *H. decumbens*, *H. Colensoi* with one-inch grey leaves on stiff branches, to the large, pale green willow-like leaves of *H. salicifolia*. *H. speciosa* is angular branched, has dark green glossy leaves with densely flowered heads of dark crimson blossoms, but is less hardy. *H. anomala* is erect with light green branches and white or pale pink rounded flower spikes. *H. cupressoides*, as the name suggests, has small cypress-like leaves, a rounded tip and a tendency to become leggy and bare at the base. It is one of the most rapid growers. *H. Lavaudiana* is a low growing plant 6-9 inches high, very densely leaved on straggling branches, the flowers pinkish.

There may be more plants from this area in the various plantings, but this gives a fair representation. These plants were secured from various sources, Scotland, northern Ireland, Canada, as well as Invercargill and Gisborne, New Zealand, and the Plant Introduction and Exchange service at Wellington, N. Z.

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ARBORETUM NOTEBOOK

This department is published for correspondence and pertinent comments by experienced growers on interesting plants and their culture. We solicit your questions but space limitation necessitates the publishing of only such answers as we deem of general interest.

GARDEN HINTS . . .

JANUARY

On one of the first mild days the deciduous trees and shrubs may be sprayed. First a dormant spray and later when the buds are swelling a milder spray may be used. When using the new sprays it would be wise to consult someone who has used them with success or otherwise. When choice has been made, follow carefully the directions on the container.

To remind you again, one of the greatest pleasures in January is forcing the budding branches. *Forsythia*, *Jasminum nudiflorum* and *Prunus Pissardii* are easy and beautiful.

Climbing roses should be examined now. Pruning may be started, especially if they were neglected in the fall and allowed to make tangles. Old wood may be cut out and long shoots cut back sparingly. "Ruth Alexander" is very strong and needs lots of attention. Besides the beautiful bloom, the big hips decorate the fall garden.

Slug-bait time is everlasting. Use slug-bait generously and often. A member of Unit No. 31 has had success with ordinary window screening. She used a strip about ten inches wide and fringed the top half inch, turning the released wires down on the back. This strip is placed around a plant, a group of plants, or along the borders. She says slugs are not able to cope with the sharp wires.

When the conifers and the broad-leaved evergreens begin to show growth they may be transplanted. With careful planting they will continue to grow with no setback.

FEBRUARY

Tamarix pentandra (aestivalis) should be pruned now. This is a valuable summer-flowering shrub. At its best it becomes a cloud of pink with pleasantly contrasting gray foliage. It should be cut back hard every year.

Winter-flowering camellias are beautiful now. A hedge of *C. Sasanqua* is a joy to look forward to. Camellias should be pruned with

much forethought and great imagination. To keep a graceful shrub open and at the desired height takes much loving care.

Before growth starts any of the herbaceous plants may be divided and transplanted. Each plant should have a feeding of bone-meal, the amount depending on the size of the plant. Mix the meal well into the soil before placing the plant.

Phlox, when planted in a mass, give one of the most brilliant displays of the year, and if planted where they have shade during the hottest part of the day, the colors do not seem to clash. They blossom at a time when the garden interest may begin to flag but a border of phlox brings an interest and pleasure few other flowers can arouse.

MARCH

March is a thrilling month in Northwest gardens. Flowering trees, early rhododendrons, *Pieris* and many of the bulbs are coming into bloom.

All roses may safely be pruned after March 15. Mr. Bryan Taylor advises thinning the old wood of Floribunda and Polyantha roses and trimming the tops back to sound wood. The climbing roses should be cut back when growing out of hand.

White Japanese Anemones definitely add to the rhododendron plantings. They bloom in the fall when rhododendron blooms have passed. Their starry, white blossoms, of good substance, complement the heavy, green foliage of the rhododendrons and both will grow well in the same locations. This is a companionship which should not be overlooked. Japanese Anemones should be planted in March.

Stachyurus praecox is a distinctive Japanese shrub blooming in the Winter Garden of the Arboretum. Perhaps its greatest value is its season of flowering, during March and April. It is a spreading, deciduous bush with noticeable, stiff, drooping, pale yellow catkins. It

would be an addition to any winter-blooming garden and is unquestionably a "conversation piece." It grows well in a clay soil and is propagated from cuttings taken in July.

 * * *

PRUNING OF CLEMATIS

If the usual principles of shrub pruning are followed, the pruning of Clematis can be fairly simple—those Clematis which flower in the spring and early summer on the previous season's growth should be pruned *after* flowering, while those that bloom on fresh growth of the current season are pruned back fairly hard in the spring, the previous season's growth being cut back practically to its base.

For pruning purposes you should know into which groups your plants fall. The most frequently grown Clematis usually fall into two groups: (1) the *Jackmanii* group, represented by the purple *Jackmanii*, the red "Madame Edouard Andre" and the pink "Comtesse de Bouchard"; (2) the *Lanuginosa* group, represented by "Nelly Moser," the white *Henryi*, and "William E. Gladstone." Both of these groups flower on the new summer growth and should be cut severely in late January or early February. When the bursting leaf buds are showing, the old growth is cut back to just above the first joint made the previous season. This will be about 16 to 18 inches above the ground. If you have never adequately pruned your Clematis you will be rewarded with stronger plants and more abundant blooms.

MRS. WARREN E. CALVIN
Lake Washington Garden Club

 * * *

An answer to a long-felt want has been found in the greenhouse at the Arboretum. A weather-proof marking pen is proving very satisfactory. It is called the Taubman Laundry-Marking pen, a quick-drying, India ink, ball-point type pen that writes easily on all labels. Mr. Buzard, on the greenhouse staff, showed me labels over a year old that were perfectly legible. The marking presumably will last as long as the paint stays on the label. With a plastic tip on the pen they cost fifty-nine cents at book stores in the University District. More elegant pens, but no more

efficient, can be purchased at a higher price. Even the cheaper ones have a clip to fasten the pen to the pocket.

 * * *

A member of Unit No. 55, the Sally Bunge Unit, sends this "Helpful Hint." If dogs bother certain plants or shrubs, sprinkle inexpensive cologne around the base. The "fragrance" will repel them.

 * * *

List of Plant Names

<i>retortus</i>	twisted back
<i>retroflexus</i>	reflexed
<i>retrofractus</i>	broken or bent backwards
<i>retusus</i>	notched slightly at a rounded apex
<i>reversus</i>	turned back
<i>revolutus</i>	rolled backwards
<i>rex</i>	king
Rhabdothamnus	Gr. rod and bush
<i>rhabdotum</i>	striped
<i>rhaibocarpum</i>	with crooked fruits
<i>rhamnifolius</i>	rhamnus-leaved
<i>rhamnooides</i>	rhamnus-like
Rhamnus	ancient Gr. name
Rapidophyllum	Gr. Rapis-leaved
Rhipis	Gr. needle
Rhazya	name of an Arab physician
Rheum	ancient Gr. name
Rhexia	Gr. rupture
<i>rhipsalioides</i>	rhipsalis-like
<i>rhizophyllus</i>	leaves rooting
<i>rhodanthus</i>	rose-flowered
<i>rhodochilus</i>	rose-lipped
Rhodochiton	Gr. red cloak (rosy-red calyx)
<i>rhodocinctus</i>	rose-girdled
Rhododendron	Gr. rose tree
Rhodohypoxis	Gr. rose Hypoxis
Rhodomyrtus	Gr. rose myrtle
<i>rhodoneurus</i>	rose-nerved
Rhodostachys	Gr. rose flower spike
Rhodothamnus	Gr. rose shrub
Rhodotypos	Gr. rose model
Rhoea	name unexplained
<i>rhoifolius</i>	rhoa-leaved
<i>rhomboideus</i>	rhomoidal
<i>rhombeus</i>	rhombic
Rhus	ancient Greek name
Rhynchosstyliis	Gr. beaked column
<i>rhytidophyllus</i>	wrinkle-leaved
Ribes	an Arabic name
Richea	for A. Riche, French naturalist
<i>ricinifolius</i>	ricinus-leaved
<i>ricinoides</i>	ricinus-like
Ricinus	a tick, for resemblance of seeds
<i>rigens</i>	stiff
<i>rigidissimus</i>	very rigid
<i>rigidulus</i>	somewhat rigid
<i>rigidus</i>	rigid, stiff
<i>ringens</i>	gaping
<i>riparius</i>	of river banks
Ririei	for Rev. B. Ririe, missionary in China
<i>rivalis</i>	pertaining to brooks
Rivina	for A. Q. Rivinus of Leipzig, d. 1722

<i>rivularis</i>	growing by streams	<i>rutaefolius</i>	ruta-leaved
Robinia	for Jean and Vespasien Robin, French herbalists	<i>rutilans</i>	glowing red
<i>robustispinus</i>	stout-spined	<i>Sabal</i>	a South American native name
<i>robustus</i>	strong, stout	<i>Sabbatia</i>	for Liberatus Sabbati, Italian botanist
Rochea	for F. de la Roche, French botanist; d. 1813	<i>saccatus</i>	saccate, bag-like
<i>Rockii</i>	for J. F. Rock, geographer and plant collector	<i>saccharatus</i>	containing sugar
Rodgersia	for Commodore John Rodgers, U. S. Navy; d. 1882	<i>saccharifera</i>	sugar-bearing
Rodriguezia	for Emanuel Rodriguez, Spanish botanist	<i>saccharinus</i>	sugary
Rohdea	for M. Rohde, German physician and botanist	<i>saccharoides</i>	like sugar-cane
<i>Rollinia</i>	for Charles Rollin, French historian	<i>Saccharum</i>	Gr. name for sugar
<i>romanus</i>	Roman	<i>saccifera</i>	bag-bearing
Romanzoffia	for Count Nicholas Romanzoff	<i>sachalinensis</i>	from the island of Sakhalin
Romneya	for Rev. T. Romney Robinson, Irish astronomer; d. 1882	<i>sacrorum</i>	of sacred places
<i>Romulea</i>	after Romulus, one of the founders of Rome	<i>Sadleria</i>	for Joseph Sadler, prof. of botany, Budapest
Rondeletia	for Wm. Rondelet, French physician; d. 1566	<i>Sageretia</i>	for Augustin Sageret, French botanist
Rosa	ancient Latin name	<i>Sagina</i>	Latin fatness,
<i>rosaceus</i>	rose-like	<i>Sagittaria</i>	alluding to forage value
<i>rosaeflorus</i>	rose-flowered	<i>salicifolius</i>	Latin arrow,
<i>roseus</i>	rosy	<i>salicinus</i>	for shape of leaves
<i>rosmarinifolius</i>	rosemary-leaved	<i>Salicornia</i>	willow-leaved
Rosmarinus	Latin, sea-dew	<i>salicornioides</i>	willow-like
<i>rostratus</i>	beaked	<i>salignus</i>	Latin, salt and horn,
<i>rosularis</i>	in rosettes	<i>salinus</i>	for habitat and branching
<i>rotatus</i>	wheel-shaped	<i>Salix</i>	Salicornia-like
<i>rotundifolius</i>	round-leaved	<i>Salpichroa</i>	of the willow
<i>rotundus</i>	round	<i>Salpiglossis</i>	of salty places
Roupala	native name in Guiana	<i>Salsola</i>	ancient Latin name for willow
<i>rubescens</i>	becoming red	<i>salsuginosus</i>	Gr., tube and skin
Rubia	Latin, red	<i>Salvia</i>	for flower characters
<i>rubicundus</i>	red, ruddy	<i>salviaefolius</i>	Gr. tube and tongue
<i>rubiginosus</i>	rusty-red	<i>Salvinia</i>	Latin, salty
<i>rubiooides</i>	rubia-like	<i>sambucifolius</i>	salt marsh loving
<i>rubricalyx</i>	with red calyx	<i>sambucinus</i>	from old Latin name
<i>rubricaulis</i>	red-stemmed	<i>Sambucus</i>	meaning to heal
<i>rubrifolius</i>	red-leaved	<i>Sanchezia</i>	salvia-leaved
<i>rubronervis</i>	red-veined	<i>sanctus</i>	for Antonio Salvini,
<i>rubropilosum</i>	red-haired	<i>Sanguinaria</i>	prof. of Greek at Florence
Rubus	old Latin name	<i>sanguineus</i>	elder-leaved
Rudbeckia	for Olaf Rudbeck and his son, professors of botany, Uppsala	<i>Sanguisorba</i>	elder-like
<i>rudis</i>	wild, not tilled	<i>Sansevieria</i>	old Latin name for the elder
<i>rudiusculus</i>	wildish	<i>Santalum</i>	for Jos. Sanchez,
Ruellia	for Jean de la Ruelle, French botanist	<i>Sanvitalia</i>	prof. of botany at Cadiz
<i>rufescens</i>	becoming reddish	<i>sapidus</i>	holy
<i>rufidulus</i>	reddish	<i>sapientum</i>	Latin blood,
<i>rufinervis</i>	reddish-nerved	<i>Sapindus</i>	referring to sap color
<i>rufohirtum</i>	reddish-haired	<i>Sapium</i>	blood-red
<i>rufosquamosum</i>	with reddish scales	<i>saponaceus</i>	Latin blood and soak up
<i>rufum</i>	red, reddish	<i>Saponaria</i>	for Raymond de Sansgrio,
<i>rugosus</i>	wrinkled	<i>Sapota</i>	Prince of Sanseviero
Rumex	old Latin name of unknown origin	<i>Sarcococca</i>	Persian name of tree
<i>runcinatus</i>	saw-toothed	<i>Sarcodes</i>	for a noble Italian family
<i>rupifragus</i>	rock-breaking	<i>Sargentianum</i>	pleasing to taste
<i>rupestris</i>	rock-loving	<i>sarmaticus</i>	of wise men
<i>rupicolus</i>	growing on cliffs or ledges	<i>sarmentosus</i>	Latin, soap and Indian
<i>ruscifolius</i>	ruscus-leaved	<i>Sarracenia</i>	Latin name used by Pliny
Ruscus	old Latin name	<i>Sasa</i>	for a resinous pine
<i>russatus</i>	reddish, russet	<i>Sassafras</i>	soapy
<i>rusticanus</i>	rustic, pertaining to the country	<i>sativus</i>	Latin, soap, for leaf qualities
Ruta	classical Gr. name of rue	<i>saturatus</i>	Mexican word
<i>ruthenicus</i>	Ruthenian (Russian)		Gr., flesh and head

Satureia	old Latin name used by Pliny	<i>secundiflorus</i>	flowering on one side
Sauromatum	Gr. lizard, referring to flower markings	<i>secundus</i>	one-sided
Saururus	Gr. lizard's tail,	<i>Securigera</i>	axe-bearing
	for inflorescence	<i>Securinega</i>	Latin, hatchet and to refuse
Saussurea	for H. B. Saussure,	<i>Sedum</i>	Latin, to sit
	Swiss philosopher	<i>segetum</i>	of corn fields
<i>saxatilis</i>	found among rocks	<i>seinghkuense</i>	from the Seinghku Valley,
Saxegothaea	for Prince Albert		Upper Burma
<i>saxiculus</i>	of Saxe-Coburg-Gotha	<i>Selaginella</i>	diminutive of Latin Selago,
Saxifraga	growing among rocks		old name of clubmoss
<i>saxosus</i>	Latin, rock and to break	<i>selaginoides</i>	clubmoss-like, selago-like
<i>scaber</i>	rocky		(To be Continued)
<i>scaberrimus</i>	scabrous, rough		1 1 1
Scabiosa	very rough		
<i>scabiosaefolius</i>	Latin, itch		
<i>scabrellus</i>	scabiosa-leaved		
<i>scabrifolium</i>	somewhat rough		
Scaevola	rough leaves		
	Latin diminutive of <i>scaevis</i> ,		
	left-handed		
Scandix	Gr., to sting		
<i>scaposus</i>	with scapes, leafless stems		
<i>scariosus</i>	scarious, dry and not green		
<i>sceprium</i>	of a scepter		
Schefflera	for J. C. Scheffler of Danzig		
Schima	Arabian name		
Schinus	Gr. for the mastic tree		
Schismatoglottis	Gr., falling tongue		
<i>schistocalyx</i>	with split calyx		
<i>schistosus</i>	slate-grey		
Schizaea	Gr., to split		
Schizanthus	Gr., split and flower		
Schizocodon	Gr., cut and bell		
<i>schizoneurus</i>	cut-nerved		
<i>schizophyllum</i>	with split covering		
Schizopetalon	Gr. petals and cut		
<i>schizophyllus</i>	cut-leaved		
Schizophagma	Gr., to cut and to break off		
Schizostylis	Gr., to cut and style		
<i>Schlippenbachii</i>	for Baron von Schlippenbach		
Schomburgkia	for Sir R. H. Schomburgk, 1804-1865		
Schotia	for Richard van der Schot; d. 1819		
Sciadopitys	Gr. umbrella and fir		
<i>sciaphilum</i>	shade-loving		
Scilla	old Gr. name		
Scindapsus	old Gr. name		
<i>scintillans</i>	sparkling		
Scirpus	old Latin for rush		
<i>sclerocarpus</i>	hard-fruited		
<i>sclerophyllus</i>	hard-leaved		
Scolymus	old Gr. name		
<i>scoparius</i>	broom or broom-like		
<i>scopulorum</i>	of the crags		
<i>scorpioides</i>	scorpion-like		
Scorpiurus	Gr., scorpion and tail		
Scorzonera	old French, meaning serpent		
<i>scorzoneroidea</i>	scorzonera-like		
scotica	Scotch		
Scrophularia	a reputed remedy for scrofula		
<i>sculptus</i>	carved		
<i>scutatus</i>	buckler-shaped		
Scutellaria	Latin, small shield		
<i>scyphocalyx</i>	cup-shaped calyx		
Searsiae	for Sarah C. Sears,		
	American artist		
<i>sebifera</i>	tallow-bearing		
<i>sebosus</i>	full of tallow		
Secale	ancient Latin name		
<i>sechellarum</i>	of the Seychelles Islands		
Sechium	West Indian name		
<i>seclusus</i>	hidden, secluded		

Some New Zealand Alpines

(Continued from Page 95)

the stony river bed, and everywhere were loaded with masses of sky-blue, translucent berries, as if someone had scattered beads on the ground.

One of the most novel of the New Zealand gymnosperms is the cypress-like "pygmy pine," or *Dacrydium laxifolium*, which scrambles over the ground or adjacent vegetation in boggy places. Specimens have been seen in fruit when barely three inches high. *Dacrydium biforme* and *D. intermedium* are small, rounded, cypress-like trees or shrubs growing in the damper regions of the mountain districts. Of special interest is the leafless conifer, *Phyllocladus alpinus*, a shrub or small tree in which the photosynthetic processes occur in glaucous, irregularly shaped, flattened branches termed cladodes. The two species of *Libocedrus*, *L. Doniana* and *L. Bidwillii*, are handsome trees similar in form to the incense cedar (*Libocedrus decurrens*) of the west coast of the United States.

Carmichaelia (*Leguminosae*) is a genus limited in distribution to New Zealand and Lord Howe Island. The alpine species are leafless as adults, and for the most part are rather low, woody plants forming compact masses of stout flattened or upright branches. Some of the best of these are *C. Enysii*, *C. uniflora* and *C. Monroi*.

One of the few deciduous trees of New Zealand is *Hoheria glabrata* (*Malvaceae*), a small, birch-like tree of the uplands which bears clusters of white flowers and is most handsome when in bloom. *Griselinia littoralis* (*Cornaceae*) is a small tree or shrub that grows in the subtropical forests of the North

Island, but also above timberline in the South Island. It has a short, twisted trunk and large, thick yellow-green leaves. It is used extensively for hedge-planting in New Zealand as it withstands poor soil and winds well. Another species which might be given more consideration in this country is *Metrosideros lucida* (*Myrtaceae*), a dense, rounded small tree widely distributed in the wetter portions of New Zealand. The terminal cymes of flowers are very showy with their abundance of bright crimson stamens.

Of the numerous pittosporums in New Zealand, few can be considered true alpines. However, *P. Colensoi* is a stout-branched small tree of the uplands and has attractive glossy leaves. *P. patulum* is another small tree with irregularly shaped leaves and sweet-scented flowers. *P. Dallii* is another handsome species which is rare in the wild, known only from one locality. It is a small, bushy shrub with long, sharply toothed leaves and bears masses of white fragrant flowers. Some of the southern beeches, *Nothofagus* (*Fagaceae*) are attractive trees, although unsuitable for the small garden as they are good-sized trees when mature. Two of the hardiest are *N. cliffortioides*, a dense, evergreen tree with small, dark-green leaves, and *N. Menziesii*, a tall tree with a silvery trunk and small, broadly ovate, toothed leaves.

Two scree plants of the Southern Alps deserve special mention. *Cotula atrata* (*Compositae*) is a low, greyish, succulent herb which bears globose black heads and bright yellow stamens. A remarkable plant is *Notothlaspi rosulatum* (*Cruciferae*) which has a pyramidal rosette of closely imbricated leaves, above which the densely crowded racemes of fragrant white flowers are borne.

Perhaps the finest *Ranunculus* known occurs in New Zealand. It is *R. Lyallii*, an abundant plant in damper parts of Stewart Island and upland South Island. The much-branched inflorescence may reach over four feet in height and bear dozens of white flowers, each 2-3 inches across. The peltate leaves are borne on long petioles, and often exceed a foot in diameter. Another handsome butter-

cup is *R. insignis*, smaller than *R. Lyallii* and with yellow flowers. There are numerous smaller species in this genus which are of interest.

The genus *Rubus* (*Rosaceae*) is not well represented in New Zealand, but two species have considerable merit. In some forms of *R. cissoides*, the leaf blades are absent, so all that remains of the leaf is a green midrib covered with bright yellow spines. Another distinct little species is *R. parvus*, a dwarf, prostrate shrub with bronzed, one-foliolate leathery leaves. The large white flowers and red fruit add to its beauty as a rock plant.

It is obvious that in a paper of this size it is possible to mention only a few of the many interesting New Zealand alpines. *Hebe*, or *Veronica*, is a valuable group which has been discussed in an earlier issue of the *Bulletin*. Those interested in learning more about New Zealand alpines and their culture should refer to the bibliography for a list of helpful books. Some living plants as well as seeds of New Zealand species are available in this country, although the selection is limited. In New Zealand there are nurseries which specialize in native plants and seeds.

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BOOK REVIEWS

"Old Man's Garden," by Annora Brown. 264 pp. (J. M. Dent & Sons (Canada) Ltd., Toronto and Vancouver, Feb., 1954). Price \$3.55.

THE author calls this a "book of gossip about the flowers of the west . . . some of the legend and lore that is to be found lying about in odd corners." Annora Brown's "Old Man" is a mythological character found in the folklore of the prairie Indian tribes. His garden stretches west from the mouth of the Mississippi River in the south to Lake Athabasca in the north. It is a garden of the mountain tops and the lowland valleys, of the desert dry lands and the swampy sphagnum bogs, a woodland garden, and a rock garden that is the living example of the beauty of restraint. A garden which gave the Indian the material for the baskets in which to collect the vegetables for his sustenance, the dyes for his garments and the medicine for his ills.

Beautifully designed and charmingly illustrated by numerous woodcuts, this is a book to be read in front of the winter's fire; to be shared with a gardening friend; a book to make this winter's dreaming more pleasurable and next summer's reality viewed with open eyes.

PAT BALLARD

"Miniature Daffodils," by Alec Gray. W. H. Collingridge, London, and Transatlantic Arts, Inc., New York (1955). 52 pp. Price 15 shillings.

FOR those who are interested in the smaller daffodils, Alec Gray's book, "Miniature Daffodils," can be recommended. As Mr. Gray states, it is not a handbook on the genus *Narcissus* but an introduction to the dwarfer species and varieties to those who are not familiar with them. He gives full details on outdoor and indoor cultivation, the pests and diseases which attack the bulbs, and how to prepare the soil for seed sowing. He describes in one chapter his method of hybridizing these delightful little flowers. Mr. Gray is responsible for many of the hybrids that are listed, each with a full description. There are 14 charming photographs of miniature daffodils. The book concludes with a list of daffodils suitable for various purposes—for naturalizing in grass, for growing in bowls and window boxes, etc. Mr. Gray writes with authority for he has been growing and hybridizing the dwarf daffodils for over thirty years.

H. M. M.

"Crab Apples for America," by Donald Wyman. 63 pp. American Association of Botanical Gardens & Arboreums, (September, 1955). Price, \$2.

THE first edition of this most useful and informative work on cultivated crab apples was published in 1943 and included 231 varieties. This second edition, from the same highly qualified source, contains 260 species and varieties, of which almost half (125) are commercially available, the rest grown in arboreta, botanic gardens and parks of the United States and Canada.

Primarily this is an alphabetical list of known cultivated crab apples, with brief details of flower and fruit characteristics, origin and a

quality rating for each; in addition, indications in which of twelve major collections they can be seen, and where in thirty listed nurseries plants can be obtained. Unfortunately, the Northwest is poorly represented by the names of only two nurserymen, one in Washington, one in Oregon, and no public collection is mentioned.

In addition to this basic information, there are a dozen other lists containing such helpful facts for selecting varieties as the order of bloom, those best for flower, fruit or foliage qualities, those with double flowers, with edible fruits, etc., together with a chart showing the length of the fruiting season at the Arnold Arboretum, Boston, Mass., and finally a list of some 240 names of obsolete or discarded varieties and doubtful names.

For nurserymen and landscape architects in particular this is an essential piece of equipment on the desk or bookshelf, but anyone else interested in crab apples will soon want to grow more of them after studying its pages. Copies are available from the Arboretum office.

B. O. M.

"Gardens Are For People," by Thomas D. Church. Reinhold Publishing Corporation, New York (1955). Price, \$10.00

THIS BOOK is a must for any garden owner interested in making his property contribute to a greater measure of outdoor living.

Whether he covers a large portion of the ground with ivy for the relaxed type of property owner who wishes his terrace to float in a sea of green, or turns the back yard into a corral to satisfy the man with equestrian leanings, Thomas Church supports the theory that the individual's personal interests are of the greatest importance and should find fulfillment in the surroundings.

He urges the gardener not to be ruled by the dictates of tradition and the stereotyped patterns of historic styles, but, within the bounds of good taste, to be governed by his own needs and desires and to realize that by satisfying these human wants he can best serve the purposes of contemporary living.

Though Mr. Church is a crusader for functional design and does stress the use of materials, both structural and natural, to provide individualized settings for people, he is not at all indifferent to the mysticism of nature. In his words, "We still have a strong tendency to control our surroundings, but in our gardens we want plants, by their structure and poetry, to suggest the fine melancholy we expect from nature."

The author displays an engaging personality and a lively humor. In describing the typical foundation planting, a planting not recommended by Mr. Church, "You watch your house gradually disappear in a miasma of various foliages—or you club them into submission, using any or all of the forms remembered from your solid geometry, leaning heavily on spheres, pyramids and cubes."

In an informal style he takes the reader on a conducted tour of many of the gardens he has

designed during twenty years of practice as one of America's foremost landscape architects. In his casual way he points out the problems that each garden owner faced and shows how they were met.

No property is too small to challenge Mr. Church, nor does he find the largest estate overpowering.

He discusses the evaluation of the site and building of new gardens, the remodeling of old gardens, the designing of city gardens, country gardens, gardens for tract houses and for beach properties. Every landscape design problem is covered, from over-all plans to garden details. Entrances, terraces, decks, curbs, seats, paving, swimming pools and planting, all come under his scrutiny.

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For any amateur or professional owning a plot of ground, "Gardens Are For People" will provide enjoyable and rewarding reading.

It is Mr. Church's hope in closing that, "What you will have is a garden more beautiful than you had anticipated, with less care than you had expected, and costing only a little more than you had planned."

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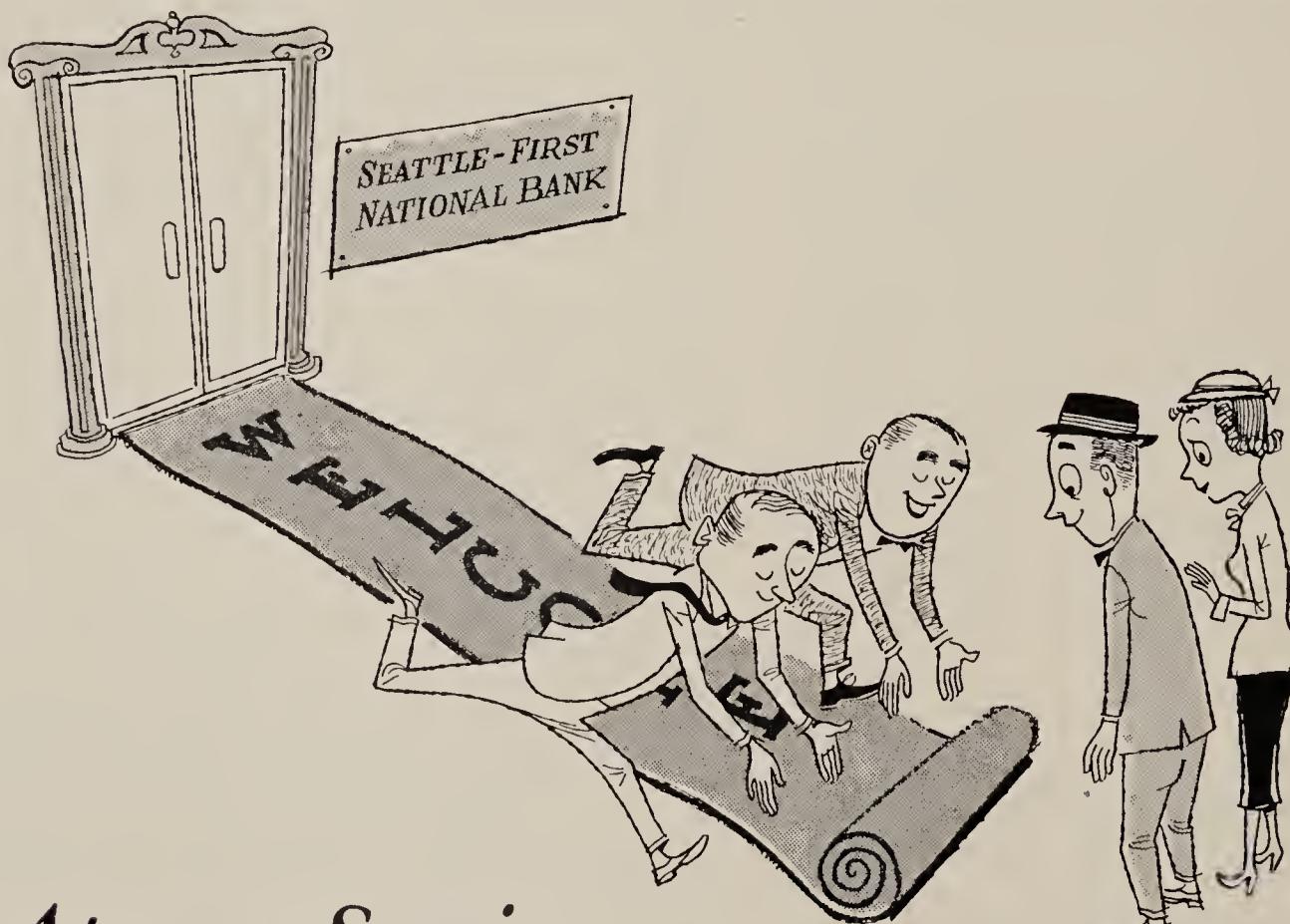


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